



NYASALAND



PROTECTORATE

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of
AGRICULTURE
For the year 1945

PART II

EXPERIMENTAL WORK

1947:

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Shortage of staff continued to result in the severe curtailment of experimental work on native crops and cultural practices but the work on tea and tung was fairly comprehensive.

TUNG

2. This section deals with investigations undertaken on the Tung Experimental Station and on certain estates in Cholo district. Mr. C. C. Webster, Agricultural Officer, was in charge of the work but, while on vacation leave, he was relieved by Mr. D. H. Laycock, Agricultural Officer.

3. Selection of promising mother trees.

As reported in previous years, the major part of the work at this station is concerned with the production of improved planting material of the species *Aleurites montana*; this is being attempted chiefly by the selection of promising mother trees in existing seedling plantations and their vegetative propagation as buddings. The work of selection, begun in 1940 with the small number of trees then in bearing, has been expanded each year since that time and in 1945 nearly 13,000 new trees were examined bringing the total number of trees so far surveyed to rather more than 40,000, which are situated in a number of plantations of varying age groups on nineteen estates. From these areas 662 provisional selections have so far been made and 68 of the more promising of these have already been propagated as buddings on seedling rootstocks and are planted in clone trials at the experimental station. For reasons explained in last year's report (para. 16) the work is handicapped by the fact that most of the plantations are young, and satisfactory results can only be expected from the laborious procedure of re-examining, and re-selecting from, the plantations for several consecutive years. Nevertheless, some outstandingly good trees have already been found and the yields of several of these are presented in Table 1. These may be compared with the average yield of seedling plantations given in Table 2.

TABLE 1
YIELDS OF SOME PROMISING MOTHER TREES, LB. DRY SEED

Age : Tree No.	4	5	6	7	8	9	10	11	12	13
E379	16.4	37.6	?	51.0	41.4	77.3				
E380	22.1	36.3	?	54.7	48.6	57.0				
E460	38.7	18.8	78.9							
E489		31.1	38.2	32.2	49.2					
ZA1A		13.8	23.3	48.0	13.9*	66.9				
ZC2A	17.3	52.8	54.0	50.5	34.2*	106.6				
ZM13	17.7	35.7	45.4	51.2	61.3	53.6	76.8	84.2	22.8*	117.8
ZN24	8.6	15.9	26.2	31.0	36.6	38.3	63.6	40.0	25.2*	50.2
ZR21	31.4	13.4	35.4	13.8*	54.0					

* Yield reduced by severe hailstorm

4. The yields of all trees in the seedling plantation at the Zomba Experimental Station were again individually recorded and a summary of these yields together with those for previous years is shown in Table 2. This year's yields were exceptionally good, probably partly because the trees matured little fruit in 1944 owing to hail damage. Frequency distributions of the trees in Groups A and C according to their yields in 1945 (when they were aged 13 and 9 years respectively) are given in Table 3. These illustrate the normal constitution of a seedling plantation which comprises something like 50% of predominantly male trees giving very little crop, and a remainder of bearing trees the majority of which are only moderate yielders but have amongst them a small number of exceptional trees, which are, of course, the aim of the selection programme.

TABLE 2
ZOMBA EXPERIMENTAL STATION, YIELDS, LB. DRY SEED

Group :-	A		B		C		D		E	
When plan- ted :-	1931/32		1934/35		1935/36		1936/37		1937/38	
No. of trees :-	123		55		211		97		69	
Age Years	per tree	per acre	per tree	per acre	per tree	per acre	per tree	per acre	per tree	per acre
3	1.5	84	1.7	95	1.8	101				
4	3.6	201	3.2	179					6.0	336
5	5.2	291			5.4	302	6.6	370	7.1	398
6	9.4	526	6.0	336	7.7	431	6.2	347	6.7*	375*
7	11.8	661	12.1	678	8.2	459	4.7*	363*	13.7	767
8	13.7	767	10.6	594	5.8*	325*	14.0	784		
9	15.1	846	6.7*	375*	16.4	918				
10	20.5	1,148	19.1	1,070						
11	18.7	1,047								
12	8.5*	478*								
13	22.5	1,260								

* Yield reduced by severe hailstorm

TABLE 3

FREQUENCY DISTRIBUTION OF TREES IN GROUPS A AND C ACCORDING TO YIELD IN 1945

Yield class lb. dry seed	0- 10	10.1 -20	20.1 -30	30.1 -40	40.1 -50	50.1 -60	60.1 -70	70.1 -80	80.1 -90	90.1 -100	100.1 -110	110.1 -120
Group A ...	51	20	10	15	12	10	2	1	1	—	—	1
Group C ...	102	39	38	10	12	4	5	—	—	—	1	—

5. Vegetative propagation as buddings.

(a) Buddings on seedling rootstocks are under trial in a number of field experiments both on the experimental station and on estates but only two of these are as yet old enough to to give yield figures of any interest.

(b) The first of these experiments, planted in December, 1940, compares unselected seedlings derived from ordinary bulk seed, "selected seedlings" raised from open pollinated seed taken from four selected trees, and budding of the same four selections on both *fordii* and *montana* stocks. The yields so far obtained from this experiment (which are low because of poor soil) are summarised in Table 4, from which it will be seen that the buddings on *montana* stock have significantly outyielded all other treatments, and that buddings on *fordii* stock were better than unselected seedlings but not superior to selected seedlings. Differences in vigour are now clearly apparent to the observer in the field, the seedling trees being distinctly bigger than the buddings and the dwarfing effect of the *fordii* stock particularly evident; these differences are reflected in the girth measurements given in Table 4. The yields obtained from the four clones used in this trial on the *montana* stock are shown in Table 5, the clone ZM13 being significantly better than all others in the fourth year.

TABLE 4

MEAN YIELDS, LB. DRY SEED

Age in years		Buddings		Seedlings		Sig.	diff.
		Montana stock	Fordii stock	Selected	Un-selected	P= 0.05	P= 0.01
2	per tree	0.27	0.29	0.02	0.02	—	—
3	per tree	1.85	1.69	0.89	0.69	0.36	0.50
	per acre*	104	95	50	39	—	—
4	Per tree	6.72	3.70	3.06	2.35	1.41	1.95
	Per acre*	376	207	171	132	—	—
$\frac{1}{2}$	Girth, inches	11.63	9.52	14.05	13.65	1.10	1.52

* All trials at the experimental station are planted at fifty-six trees per acre

TABLE 5

MEAN YIELDS, LB. DRY SEED

Age in years		Clones							
				ZM8		ZM13		ZH14	ZF9
3	...	Per tree	...	1.75	...	1.90	...	2.50	1.25
	...	Per acre	...	87	...	107	...	140	70
4	...	Per tree	...	6.10	...	9.30	...	6.12	5.37
	...	Per acre	...	342	...	521	...	343	301

(c) Further yield records from clones of buddings are available from the inter-cropping trial at the station, the average yield obtained from the five clones of this experiment under all cultural treatments and also on the soya plots only, being shown in Table 8. In both sets of figures it will be seen that clones 14 and 10 are significantly better than the others, there being no significant difference between 14 and 10 or between ZN24, ZM8 and ZF9.

(d) The crop from a number of plots of buddings at Kamponje Estate was again recorded, and these figures are given in Table 6. The yields from the different clones are not strictly comparable, as they are in the replicated trials described above, but clones in the same field may be regarded as being under similar conditions and the yields as a whole serve as some indication of what may be expected from buddings under normal estate conditions. It was mentioned in last year's report (para. 18.d) that the yields from these clones in their third year were not quite up to expectations, but they appear to have made up for this by giving a heavy crop in the fourth year.

TABLE 6

MEAN YIELDS, LB. DRY SEED

Field ...	A			B			C		D			E	
Clone ...	ZL22	ZO23	14	ZH14	ZM8	ZK3	4	10	ZN23	ZO8	ZM13	14	ZH14
No. of trees ...	20	19	20	10	19	13	20	20	7	9	12	83	28
Two years ...	4.0	5.1	7.8	2.9	2.4	2.8	2.6	4.5	5.5	8.6	9.6	—	—
Three years ...	2.9	4.0	4.6	2.2	2.4	5.8	1.8	1.3	3.6	7.8	4.1	—	—
Four years ...	10.3	11.6	16.0	14.3	12.4	22.4	7.5	12.4	11.8	14.6	21.5	22.5	17.2

(e) Although little information is yet available about performance of buddings the figures given above do demonstrate the superiority of buddings to seedlings, and it will be seen that there are seven clones which have given from 12 to 122 lb. dry seed in their fourth year, or from three to six times as much as a good seedling plantation gave at the same age. (See Table 2). It is hoped that better yields will be obtained from some of the newer clones, as amongst the more recently selected mother trees there are a number which are proving superior to those from which most of the earlier clones are derived.

6. Other methods of producing improved planting material.

As recorded in last year's report experiments are in progress with seedlings raised from open pollinated seed of selected trees (para. 22 (a)) with clonal seedlings (para. 22 (b)) and with legitimate seedling families (para. 21) but no results are yet available from these trials. The possibility of improving and standardising rootstocks is also being investigated. Experiments on the rooting of clonal material as cuttings were planned but could not be carried out during 1945. Artificial selfing of flowers on certain selected trees was done in the 1945 season with the object of producing seed from which to raise legitimate seedling rootstocks. Such stocks probably show less variation than the ordinary seedlings so far used although they will, of course, be comparable with vegetatively propagated clonal stocks.

7. Cultural and manurial experiments.

The only field trial of this nature from which any data of interest is available is that planted in December, 1940, which compares intercropping during the first four rainy seasons with (a) soya beans; plants removed when harvesting beans; (b) maize, trash buried after harvest; (c) green manure crop of velvet beans dug in annually; (d) cover crop of *Calapogonium mucunoides*, intended to be permanent but which died out during the fourth season owing to failure to set seed. The main plots of this trial are split to provide for a comparison of five clones the yields of which are shown in Table 8. The yields for the four cultural treatments are shown in Table 7. The consistent superiority of the soya plots appears to indicate an advantage from clean cultivation with a crop which does not take much from the soil. The *Calapogonium* plots, which received least cultivation of all, are the worst, while maize and velvet beans are intermediate. Several more years yield records are required before definite conclusion can be drawn.

TABLE 7

MEAN YIELDS, LB. DRY SEED

Age in years		TREATMENTS				Sig. diff.	
		Soya	Maize	Velvet	Calapogonium	P=0.05	P=0.01
2	per tree ...	1.53	1.51	0.77	1.06	0.36	0.49
	Per acre ...	86	85	43	59	—	—
3	Per tree ...	4.91	2.33	2.35	1.83	0.63	0.87
	Per acre ...	275	130	132	103	—	—
4	Per tree ...	10.10	7.21	6.34	4.80	1.43	1.95
	Per acre ...	566	404	355	269	—	—

TABLE 8
MEAN YIELDS, LB. DRY SEED

Age in years	CLONES											
	ZN24		ZM8		14		ZF9		10		Sig. diff. per tree	
	Per tree	Per acre	Per tree	Per acre	Per tree	Per acre	Per tree	Per acre	Per tree	Per acre	P=0.05	P=0.01
All plots :												
2	0.70	39	0.48	27	2.14	120	0.58	32	2.18	122	0.31	0.41
3	1.59	89	1.59	89	4.96	278	2.11	118	4.03	226	0.61	0.80
4	6.35	356	5.03	282	9.96	558	5.08	284	9.16	513	1.39	1.82
Soya plots only :												
2	1.03	58	0.43	24	2.37	133	0.77	43	3.07	172	—	—
3	3.40	190	2.22	24	7.72	432	3.65	204	7.57	424	—	—
4	9.15	512	6.62	71	13.85	776	7.55	423	13.33	746	2.78	3.65

8. Miscellaneous.

Certain other investigations into the flowering habits of different clones, the effect of fruit thinning on yield, application of fertilizer, spacing of trees, storage and germination of seed and the variation in the oil content of seed from different clones, have not yet reached a stage at which results can be published.

TEA

9. This section covers the work undertaken on the tea crop in Mlanje district with special reference to the investigations carried out on the Mlanje Tea Station. This work was in the charge of Mr. A. P. S. Forbes, Agricultural Officer.

Down pruning old tea.

This experiment was laid down in 1944 in order to investigate the present and other possible methods of treating down pruned old China Jat tea. When the tea broke away from 14" prune the following tipping treatments were applied :—

- (1) Tea tipped 27 inches
- (2) " " 27 "
- (3) " " 27 "
- (4) " " 18 "

The complete sequence of tipping and pruning treatments follows :—

(1) Prune down to 14 inches and then tip to 27 inches ; cut across the following year to 22 inches and tip 26 inches ; prune the next year to 20 inches tipping at 4 inches and prune up to 2 inches yearly tipping at 4 inches.

(2) Prune down to 14 inches and then 27 inches ; prune up yearly 1 inch tipping at 27 inches until 18 inches pruning level is reached and then tip up to 4 inches yearly.

(3) Prune 14 inches tip 27 inches ; prune 24 inches tip 28 inches ; prune down yearly inch by inch until 20 inches is reached tipping 4 inches up each year ; thereupon prune up 1 inch yearly until 24 inches is reached, tipping 4 inches yearly.

(4) Prune 14 inches and tip 18 inches ; prune up 1 inch yearly and tip at 4 inches.

The experimental area was otherwise treated exactly the same as the rest of the estate.

TABLE 9

Treatment No.	...	...	...	...	1	2	3	4	S.D.	
									P=0.05	P=0.01
Yield per acre in lb. made tea			...	...	627	651	608	693	116.1	160.6
Percentage of No. 1	...	...	...	...	100	104	97	111	18	26

The results from the first season show that there was no significant difference in yield between the treatments, *i.e.* the 18" tipping did not reduce the yield as is the common contention and there was no apparent difference in the development of the wood.

10. Tipping levels of China Jat and influence of pruning methods on tipping.

In a previous investigation into the influence of tipping level on yield in Indian Jat and the effect of type of prune on tipping it was shown that to tip higher than 4 inches tended to reduce the yield of tea. A similar experiment was laid down in a China Jat garden in 1941 with the following treatment :—

- (1) Cut across tipped 2"
- (2) Cut across tipped 4"
- (3) Cut across tipped 6"
- (4) Clean pruned 2"
- (5) Clean pruned 4"
- (6) Clean pruned 6"

Apart from the pruning and tipping all other operations were exactly similar to those on the remainder of the estate.

Unfortunately the experiment was ruined by misadventure in 1943/44 and the investigation was restarted in June 1944. The results from the 1944/45 season were not significant but the 2 inch tipping on clean pruned tea continued to give higher yields.

TABLE 10

Treatment No.	1	2	3	4	5	6	S.D.	
							P=0.05	P=0.01
Made tea per acre	452	492	479	510	446	465	117	163
Percentage of No. 5	101	110	107	114	100	104	26	36

11. Treatment of young tea.

A field of tea planted in March, 1942, received the following treatments :—

(1) At twelve months to eighteen months after planting the young plants were centred (*i.e.* the central main stems were removed to encourage the bush to spread). The bush was cut level at 14 inches and tipped to 27 inches and then plucked.

(2) At nine months onward the young plants were lightly plucked, the bush was pruned at thirty months for the first time.

(3) The bush was cut across to 14 inches at eighteen months, tipped at 27 inches, and then up-pruned 2 inches yearly and tipped at 4 inches above pruning level.

(4) The bush was cut across to 8 inches at eighteen months, tipped at 27 inches, and then pruned to 14 inches at thirty months.

(5) The bush was cut across to 16 inches at eighteen months, left two years, and then up-pruned to 2 inches yearly.

(6) The bush was allowed to grow for two and a half years and then pruned at 14 inches and up-pruned 2 inches yearly.

A latin square layout was used and all other cultural operations were the same as the general station routine.

In 1943 treatment (2) gave a significantly higher yield than all other treatments and in 1944 treatments (1) and (5) gave significantly higher yields than treatment (6); treatments (2) and (5) being significantly higher than treatment (1). In the past season treatments (1)—(5) again gave significantly higher yields than treatment (6) but there was no difference between individual treatments.

Treatments (2) and (5) continued to give the best developed bushes, the bushes in both being almost touching.

TABLE 11

Treatment No.	1	2	3	4	5	6	S.D.	
							P=0.05	P=0.01
Made tea per acre	315	356	359	293	368	213	75.57	103.07
Percentage of No. 6	147	167	168	137	172	100	35.4	48.3

The conclusion which continues to be drawn from this investigation is that young tea responds to hard treatment, at least in the early stages of its growth.

12. Spacing of tea.

This experiment was designed to investigate the optimum spacing of tea and the following treatments were applied :—

(1) $3\frac{1}{2}$ feet by $3\frac{1}{2}$ feet.

(2) 4 feet by 4 feet.

(3) $4\frac{1}{2}$ feet by $4\frac{1}{2}$ feet.

(4) 5 feet by 5 feet.

It will be recalled that in 1942/43 treatment (1) gave a significantly higher yield than all the other treatments and treatment (2) was significantly higher than treatment (4). In the following season treatments (1), (2) and (3) gave significantly higher yields than treatments (4) and treatment (1) was significantly higher than (3). In the past season treatments (1) and (2) continued to give a significantly higher yield than treatment (4).

TABLE 12

Treatment No.	1	2	3	4	S.D.	
					P=0.05	P=0.01
Made tea per acre	1,130	1,092	1,036	892	103	147
Percentage of No. 2	106	100	95	82	9	13

The results continue to indicate that the closer the spacing the higher the yield of tea.

13. Investigation of different methods of pruning and of extending the pruning cycle.

In 1944, after a trial lasting 6 years, it was concluded that the yearly pruning of Indian Jat tea significantly reduced the yield of made tea per acre when compared with extended pruning cycle tea. The following are the treatments :—

- (1) Clean pruned every year.
- (2) Cut across pruned every year.
- (3) Cut across with the centre cleaned out every year.
- (4) Clean pruned 1941, unpruned 1942, and clean pruned 1943.
- (5) Cut across pruned 1941, unpruned 1942, and cut across pruned 1943.
- (6) Clean pruned 1941, unpruned 1942 and 1943, and clean pruned 1944.

In January, 1945, it was noted that the cut across plots were not flushing as well as usual and although they improved as the season advanced nevertheless they could be picked out by eye due to the lighter colour of the foliage. The following were the results :—

TABLE 13

Treatment No.	1	2	3	4	5	6	P=0.05	P=0.01
Yield made tea per acre	1,542	1,512	1,543	1,717	1,598	1,841	223	305
Percentage of No. 1 treatment ...	100	98	100	111.3	103.6	119.3	14.4	19.7

It will be noted that for the first time since 1941 the three yearly pruned treatments (1) to (3) gave no difference in yield and that treatments (4) and (5) were not significantly higher than the yearly treatments. The three-year extended pruning cycle treatment (6) gave significantly higher yields than (1), (2), (3) and (5) and, for the first time, the clean pruned extended cycle tea (6) gave a significantly higher yield than the cut across extended pruned cycle tea (5). The general conclusion is the same as in the past, namely that whenever the climatic conditions allow, Indian Jat tea should not be pruned yearly.

14. Time of application of fertilizer to tea.

The experiment is laid out in the form of a randomised block with the following treatments :—

- (1) Whole application of fertilizer applied in first week of November.
- (2) Whole applied in first week of January.
- (3) Half application in the first week of November and half in the first week of January.
- (4) Half application in the first week of November and half in the first week of March.

Originally a mixture was used consisting of nitrogen, phosphate and potash in the ratio of 4 : 2 : 1 and applied at the rate of 170 lb. per acre. Since 1943 only sulphate of ammonia has been applied, at the rate of 170 lb. per acre, due to the impossibility of obtaining potash and phosphate.

Apart from 1943 when treatment (4) gave a significantly higher yield than the rest, the treatments in the past have shown no differences in yield except that treatment (4) yearly gave the highest yield. The following are the results from the 1944/45 season.

TABLE 14

Treatment No.	1	2	3	4	S.D.	
					P=0.05	P=0.01
Made tea per acre in lb.	1,277	1,317	1,307	1,433	191	275
Percentage of No. 1	100	103	102	112	15	21

Once again the results indicated that under the conditions of the experiment the yield of tea was not affected by the time of application of the fertilizer. It is noted however that a consistently higher yield is obtained when half the fertilizer is applied before the rains in November and half in March before pruning.

15. Cultivation experiment.

The following experiment was laid down to investigate the effect on the yield of tea of the following treatment :—

- (1) Hand weeding
- (2) Weeds slashed down.
- (3) Weeds hoed and carried off.
- (4) Weeds hoed and buried.
- (5) Weeds hoed and left on the surface.
- (6) Left unweeded.

There were no significant differences between the treatments.

TABLE 15

Treatment No. ...	1	2	3	4	5	6	P=0.05
Made tea per acre ...	1,247 ...	1,169 ...	1,265 ...	1,270 ...	1,144 ...	1,152 ...	213
Percentage of No. 6	108 ...	101 ...	110 ...	110 ...	99 ...	100 ...	18

Although no conclusions can be drawn from the results to date, nevertheless it would appear that the cultivation which is considered by many planters to be essential in order to obtain a maximum yield of tea, may not be necessary and in some years may actually be detrimental to the tea. The hand-weeding treatment in which the ground and the tea roots are not disturbed in the growing season, and the unweeded and slashing treatments, have consistently shown little difference in the actual yield of tea per acre compared to the other treatments. There is also evidence that the commonly expressed theory that the yield of an estate is drastically reduced when fields are "dirty" may not in actual fact be true. Tea has not to compete with the weeds, but rather the weeds have to compete with the tea; the tea being well established.

16. Miscellaneous.

(a) NURSERY EXPERIMENTS.

The second series of three investigations being undertaken in the tea nurseries will be left another season before results are obtained as the stumps are still too small for digging.

(b) SELECTION OF HIGH YIELDING TEA BUSHES.

This work continued in a small way. Tea of the clones finally selected in 1944 are now undergoing an investigation to find the best method under field conditions of vegetative propagation and to find if the response of a given treatment varies with the clone used. No results have yet been obtained.

17. Native Crops. General Experimental Work.

The work undertaken in this section was in charge of Mr. W. V. Rose, Agricultural Officer, in the Southern Province and of Mr. H. W. T. Webb, Agricultural Officer, in the Central Province.

(a) FLAT VERSUS RIDGE-CULTIVATION.

This experiment was started in 1941 at Port Herald and Makanga to determine whether ridge cultivation would have any effect on crop yields on the sandy soils which are common in parts of the Lower River area. The experiment was originally a 5 x 5 latin square. The results in the past three years have shown no significant differences between the following treatments:—

- (A) Planting on the flat (native fashion).
- (B) Planting on the top of contour ridges.
- (C) Planting in the furrow between ridges.
- (D) Planting in the furrow, and later splitting the ridges back on to the young plants.
- (E) Planting on the side of the ridges.

Plot yields have been very variable and the error variance high, tending to mask any significant difference that there might be between the treatments.

In the 1944/45 season, the layout of the experiment was changed to a randomised block, in the hope that this design would give better control over plot variations. The number of treatments was reduced in order to facilitate the use of long narrow plots and to increase the number of replications; treatment (E) above was eliminated. The indicator crop used was again a mixture of sorghum and millet. The use of this mixture (both types of seed are mixed and planted together in the same hole) presented certain difficulties and, in the following season, a pure stand of sorghum will be used. The yields of sorghum and millet (weight of unthreshed heads in lb.) from the various treatments were as follows:—

TABLE 16

YIELDS OF BULRUSH MILLET (UNTHRESHED HEADS)										
Treatments	...	A	B	C	D	Significant difference				
Yields/acre	...	515.9	...	490.2	...	448.6	...	461.3	...	Not significant
Shelling out turn 52.6%										

YIELDS OF SORGHUM (UNTHRESHED HEADS)										
Treatments	...	A	...	B	...	C	...	D	...	Significant difference
Yields (lb./acre)	...	1500.4	...	1153.1	...	1254.5	...	1104.4	...	Not significant
Shelling out-turn 63.9%										

TOTAL YIELD						
Treatment ...	A	B	C	D	Significant difference	
Yield in lb./acre ...	2016.3	1643.0	1703.1	1565.7	Not significant	

Owing to difficulties in thinning out the plants when a mixture is planted, also because of damage done by birds, a count of the number of plants actually harvested from each plot was made but the coefficient of regression of yield on plant number was not significant, showing that the number of plants per plot had not appreciably affected the yield. The results again showed no significant differences between the various treatments.

(b) ORGANIC MANURIAL EXPERIMENT.

This experiment, the object of which is to determine the effect of various types of organic manure on crop yields, was laid down at Port Herald for the fifth year in succession. Results in previous years have only once been significant—it being shown that compost at the rate of 30 tons to the acre gave superior yields. The treatments are as follows :—

1. *Compost* applied in August at the rate of 30 tons per acre.
2. *Green Manure*. Plot green-manured in the first year, and again when yields begin to drop.
3. *Burying*. All plant refuse buried as soon after harvest as possible.
4. *Burning*. Plant refuse burnt in the native fashion.

The indicator crop was again a mixture of sorghum and millet planted in the native fashion.

The yields are given in unthreshed head-weight in lb. and results were as follows :—

TABLE 17
YIELDS IN LB. UNTHRESHED HEADS

Treatment	...	...	...	Compost	Burying	Green manuring	Burning	Significant Difference
Yield of bulrush millet (lb./acre)	...			717.7	837.9	693.5	688.8	Not significant
Yield of Sorghum in lb./acre	...			1,900.0	1,619.5	1,325.8	1,323.5	Not significant
Total	...	...	...	2,617.7	2,457.4	2,019.3	2,012.3	Not significant

Shelling out-turn sorghum approx. 67%

Shelling out-turn millet approx. 59.5%

The failure of compost to give any significantly better return may be due to early application (August).

(c) MAIZE CULTIVATION EXPERIMENT.

This trial was conducted at Likuni, Golomoti and Tiwi in the Central Province with the following treatments :—

1. Preliminary cultivation versus no preliminary cultivation (native practice).
2. Burying versus burning of maize trash.
3. Maize spacing ; ridges 3' apart (3 plants, 4' 6" apart in the ridge) versus ridges 4' 6" apart, 3 plants 3' apart (common native practice).
4. Light hoeing versus burial of weeds during cultivation (native practice).

This is the first year in which any results have been evident. At Likuni there are indications (though not significant) that pre-cultivation has a beneficial effect. Burying maize trash caused a significant reduction in the yield at Likuni only. The closer inter-row spacing has produced a significant benefit in each case. The burial of weeds during cultivation tended to reduce the yield at Tiwi whereas at Likuni there was a slight reverse effect.

(d) MAIZE HARVESTING AND MULCHING EXPERIMENT.

This experiment was designed by Mr. E. O. Pearson of the Empire Cotton Growing Corporation and has been carried out on behalf of the Corporation.

The object was to determine the effect of date of harvesting on yields of maize and of the inter-planted cotton crop and also the effect of various cultivation treatments on the following maize crop. Some treatments were harvested early in order to determine what proportion of the crop would be lost by having all cotton uprooted at the end of July, thus extending the "dead" season.

Design and Layout.

A randomised block layout was used, consisting of 6 blocks each containing 5 plots to accommodate the following treatments :—

A. *Early Stocking-Dug*. Maize was cut at ground level, carried off the plot and stooked at 105 days (15 weeks) after planting. When dry the cobs were removed and the maize stalks returned to the plot and laid between the cotton rows as a mulch. All cotton cut out at the end of July and the stalks removed when dry. The plot was then dug over, the maize stalks burned, and the plot then left without weeding until prepared for the next harvest.

B. *Late Stooking-Bare Fallow*. Maize cut at ground level, carried off and stooked, at 119 days (17 weeks after planting). These stalks were put on treatment C plots as mulch after the dry cobs were removed.

All cotton was cut out at the end of July and all weeds, stalks, etc. were removed from the field and the plot left completely bare.

C. *Layering-Mulched*. Maize bent over at about 18" above ground level at 119 days (17 weeks after planting) and left to dry off. When dry the cobs were harvested.

All cotton cut out at the end of July and the cotton plants together with maize stalks from treatment B were spread over the field to form an even mulch.

D. *Stripping-unweeded*. At 105 days (15 weeks) after planting the top of the maize plants were bent over and all leaves removed from the plants. The cobs were harvested when dry and the maize stalks uprooted and laid between the rows of cotton. No weeding or clearing was carried out after the maize was stripped. The cotton was uprooted at the end of July and left on the plot.

E. *African Style-Control*. Maize left standing in the plot until mature, *i.e.* about 133 days after planting, then harvested and the plants uprooted and laid between the rows of cotton. Cotton cut out at the end of October, then all stalks and weeds removed and the plot left bare.

The maize cobs from all treatments were harvested and weighed at the same time.

Sampling.

Two samples of cobs were chosen at random from each plot and these were kept separate and each was subsequently bulked with one sample from each of the other plots of the same treatment, resulting in two samples from each treatment consisting of 120 cobs.

These samples were weighed separately, shelled and the grain from each sample weighed.

Results.

TABLE 18						
YIELDS OF MAIZE (LB. UNSHELLED COBS)						
Treatment	A	B	C	D	E	Significant Difference
Yields/acre	... 3,021 ...	3,377 ...	3,185 ...	2,819 ...	2,916 ...	649

The differences between treatment yields were not significant.

Samples.

TABLE 19							
Treatment No.		Weight of 120 cobs in lb.		Weight of grain in lb.		Percentage of grain in cobs	Total
A (a)	...	50	...	35	...		
(b)	...	41	...	28	...	69.2	...
B (a)	...	45	...	30	...		59
(b)	...	43	...	29	...	67.0	...
C (a)	...	52	...	35	...		69 lb.
(b)	...	51	...	34	...	67.9	...
D (a)	...	118	...	33	...		63 lb.
(b)	...	46	...	30	...	67.0	...
E (a)	...	47	...	32	...		63 lb.
(b)	...	48	...	31	...	66.3	...

These percentages indicate that the maize in treatment A probably had a higher moisture content than maize harvested in the native fashion.

Rather more prolonged drying than was actually carried out would be necessary to demonstrate this significantly.

TABLE 20						
YIELDS OF COTTON (LBS. SEED COTTON)						
Treatment	... A	B	C	D	E	Significant Difference
Yields in lb./acre	685.4 ...	665.2 ...	490.6 ...	415.9 ...	539.6 ...	Not significant

The plot variability is too wide and the differences between yields just fail to be significant.

The plot was heavily damaged by insect pests although not so much as other fields on the station ; this field was rather isolated and surrounded by fallow fields.

This experiment is a slight modification of an experiment carried out by Mr. E. O. Pearson during the 1943/44 season. In that experiment a similar result was obtained for maize *i.e.* early harvesting up to 4 weeks before the usual native time of harvesting, did not significantly depress the yield of maize. Yields of cotton from the plots from which the maize was removed early were significantly better than the plots which were treated in the native fashion although the former were uprooted at the end of July, whereas cotton was harvested from the native plots at the end of October. In view of these results, it is interesting, in spite of the fact that this year's results are not significant, that the early harvesting, although again not depressing maize yields, has given results of the same order for cotton. This is especially so in view of the fact that insect damage was particularly high this year and most of the cotton in this area was bought on the cotton markets in October. The following market figures illustrate this.

TABLE 21						
				Market		
				Chiromo	Mlolo	
Purchases bought at end of September	...	...	...	236,237	...	46,660
Total bought for season	...	...	...	365,425	...	342,858

(e) EFFECT OF SPACING AND DATE OF PLANTING OF MAIZE ON INTER-PLANTED COTTON.

It has been shown by the Messrs. E. O. Pearson and B. L. Mitchell that the resting period of long-term pupae of red bollworm is prolonged by high soil temperatures. This experiment was laid down to determine whether a surface mulch consisting of weeds and plant refuse spread on the land after harvest would be adequate to effect the emergence of long-term pupae and also to determine the effect on the yield of the subsequent crop.

The experiment consisted of a latin square layout there being 6 replications of each of the following treatments.

1. *Bare Fallow*. Cotton cut out at the end of July and all cotton and maize stalks removed from the plot and cotton burnt. Maize stalks used to mulch treatment. Weeds cut out and plot left completely bare.

2. *Dug.* Cotton cut and removed at the end of July. Weeds and maize stalks dug in.
3. *Mulched.* Cotton cut out and left on the plot. Maize stalks from this treatment and also the plots under treatment 1 added as mulch. Weeds left undisturbed.
4. *Unweeded.* No hoeing after the maize harvest in April. Cotton only cut out at the end of July removed and burnt and weeds left undisturbed. Maize stalks spread evenly on treatment 5.
5. *Control.* Cotton left standing until October 31st and maize stalks from treatment 4 spread evenly as a mulch.
6. *Heavy weeds.* Maize stalks left on the plot and weeds left undisturbed until plot prepared for planting.

Maize yields were as follows :—

TABLE 22

Treatment No.	1	2	3	4	5	6
Lb. dry cobs	1,408	1,493	1,297	1,418	1,386	1,316

The differences between treatment yields were not significant. It is however of interest to note that in spite of being buried at the end of July the maize stalks have not had a depressing effect on yield.

(f) MAIZE/COTTON PLANTING EXPERIMENT.

This experiment was planned to determine the effect of spacing and date of planting of maize on the interplanted cotton crop.

Design and Layout.

The experiment consisted of 6 main blocks each of which was divided into sub-blocks, which were in turn divided into 8 plots.

One sub-block in each block carried the early and the other the late treatments of maize and the following treatments were randomised between the plots in each sub-block.

A. Maize rows 3 feet apart, holes 2 feet apart, 2 plants per hole. Cotton half-way between rows of maize, hole 2 feet apart.

B. Maize rows 3 feet apart, holes 4 feet apart, 4 plants per hole. Cotton half-way between rows of maize, holes 2 feet apart. In both 1 and 2, each row of cotton is thus 18 inches from a row of maize.

C. Maize rows 4 feet apart, holes 18 inches apart, 2 plants per hole. Cotton half-way between rows of maize, holes 18 inches apart.

D. Maize rows 4 feet apart, holes 3 feet apart, 4 plants per hole. Cotton half-way between rows of maize, holes 18 inches apart. In both 3 and 4, each row of cotton is 2 feet from a row of maize.

E. Maize rows 6 feet apart, holes 6 inches apart, 1 plant per hole. Cotton with 2 rows between each pair of maize rows, holes 2 feet apart.

F. Maize rows 6 feet apart, holes 1 foot apart, 2 plants per hole. Two rows of cotton between each pair of maize rows, holes 2 feet apart.

G. Maize rows 6 feet apart, holes 4 feet apart, 4 plants per hole. Two rows of cotton between each pair of maize rows, holes 2 feet apart.

H. Pure stand cotton.

The density of both maize and cotton in each of these treatments is thus 1 plant per 3 sq. feet except in treatment 7, where the maize density is only 1 plant per 6 sq. foot.

The early maize was planted on the 21st November, the late maize on the 14th December. The cotton was planted early in January. Yields of maize (lb. unshelled maize) were as follows :—

TABLE 23
MAIZE YIELDS (LB. UNSHELLED MAIZE)

Treatments	2'	4'	18"	3'	6"	1'	4'	Total	Significant difference	
	A	B	C	D	E	F	G			
Yields in lb./acre of EARLY planted maize	4,620	4,627	4,803	4,688	4,101	4,112	2,686	4,230	P=0.01 1,509	P=0.05 587
Yields of late-planted maize in lb./acre	3,190	2,545	3,104	2,927	2,351	2,610	2,041	2,679	Significant difference	
Total	3,904	3,585	3,953	3,807	3,225	3,360	2,363		P=0.05 451	P=0.01 592

There is no significant difference between the whole plot yield of Treatments A, C, D.

A. and C. are significantly better than all treatments at P=0.01

D. is " " B at P=0.05

A, C, D. " " E, F, G. at P=0.01.

There is no significant difference between E and F.

The difference in yields between early and late planted maize is highly significant.

The interaction between date of planting and spacing is not significant.

Cotton yields from this experiment in lb. seed cotton are as follows :—

TABLE 24
SEED COTTON YIELDS (LB./ACRE)

Treatments ...	A	B	C	D	E	F	G	H	Total	Significant difference
Yields of cotton in early maize ...	116.2	119.5	102.6	163.8	185.4	130.3	307.8	451.8	197.1	P=0.05 P=0.01 not significant
Yields of cotton in late maize ...	128.1	135.3	95.7	103.6	129.6	123.4	113.0	309.2	142.3	
Total ...	122.2	127.4	99.1	133.7	157.5	126.9	210.4	380.5		52.3 68.8 1.80

Cotton yields are not affected by diminishing the inter-row spacing.

The whole plot yields from treatment :—

H is significantly better than all others at $P=0.01$

G is significantly better than E at $P=0.05$

G is significantly better than all other treatments at $P=0.01$

E just fails to be better than C.

There is no significant difference in the yields from treatment A, B, C, E, G.

The difference in yield between early and late planted cotton is significant at $P=0.05$.

The effect of spacing on yields are as follows :—

TABLE 25
INTER-ROW SPACING

Treatments ...	...	...	3'	4'	6'	...	...	...	...	Significant difference
										$P=0.05$ $P=0.01$
Yields of maize in lb./acre	...	...	3,745	...	3,880	...	2,983	...	159	...
									Pure stand	Significant difference
										$P=0.05$ $P=0.01$
Yields of seed cotton in lb./acre	...	...	124.8	...	116.4	...	104.9	...	380.5	...
									26.1	...
										34.4

The following figures give some indication of the effect of spacing and the time of planting of maize on the "earliness" of the interplanted cotton crop. Figures are given showing the weight of seed cotton harvested before the 31st of July in comparison with the weights harvested from August 1st to October 31st.

TABLE 26
(WEIGHT SEED COTTON IN LB.)

Treatment No. ...	A	B	C	D	E	F	G	H
Weight harvested from "early" plots before July 31st ...	1.9	2.3	2.5	6.3	17.4	11.2	37.0	55.3
Weight harvested from "late" plots before July ...	1.6	3.3	2.5	4.9	5.8	3.9	7.3	38.6
Total harvested ...	67.9	70.8	55.1	74.3	87.5	70.5	116.9	211.4
Percentage of total harvested before July 31st. ...	5.15	7.91	9.07	15.08	26.52	21.42	37.39	44.42

The cotton in this experiment made extremely luxuriant growth and set a very heavy crop of bolls. However, bollworm attack was extremely heavy and a large proportion of the bolls failed to reach maturity. 1945 was a "late" year and most of the commercial crop from this area was harvested in October, so that any figures showing that any treatment has tended to produce earliness in the cotton crop are of special interest.

(8) Miscellaneous.

In addition to these experiments others are in progress on different experimental stations and seed farms throughout the Protectorate, investigating the merits and disadvantages of certain accepted peasant agricultural practices, modifications of these practices and the effect of the introduction of new agricultural systems on the present African agricultural framework. These experiments have not been in progress sufficiently long to have reached a stage at which results can be published.

NATIVE CROPS VARIETAL TRIALS

18. Wheat variety trial.

This trial was conducted at Dedza (5,000') with winter wheat sown on 15th May in moist valley bottoms on alluvial soils. The results were as follows :—

TABLE 27

<i>Variety</i>	<i>Yield (lb./acre)</i>
Grenadero Klein ...	1,540
261.5.10 C. 1.A ...	1,280
Matopos ...	1,120
C.T.1 ...	1,120
Dedza mixture ...	1,150
Kruger ...	870

Significant difference : 640 lbs. per acre.

Owing to uneven growth in some blocks the standard error was high, but the experiment confirmed Grenadero Klein, the variety which has been bulked and distributed in the Dedza district, as the highest yielder for winter sowing in moist valley soils.

Five varieties were imported from Kenya and grown in observation plots.

TABLE 28

261.5.10. C.1.A	=	K.1
261.R.7. C.1. B	=	K.2
184.p.2. a. 1. e.	=	K.33
294.B.2. A.3	=	K.4
294.H.2. A.3.	=	K.5

All these varieties showed excellent rust-resistance, but K4 and K5 had no awns and are therefore useless for this country where bird resistance is essential. None of the other three did well in a rather dry situation but K1 and K2 are worth further trial. K2 tillered very vigorously, which is a great advantage when, as is common among native growers, too low a seed rate is employed.

Four varieties were imported from South Africa and grown under observation in two "dimbas" in Dedza, Klipkous and Regent, though rust-resistant, were awnless and so useless for this country. Koalisia was rust-resistant but appears to be a poor yielder under local conditions. The best was Vo-ventoe which was rust-resistant and gave quite a good yield, 845 lb. per acre, on a rather poor patch of soil.

Of the varieties received from S. Rhodesia, Kruger, Pusa and Beltista have now shown that they do not yield well under Nyasaland conditions.

Sabanero continued to be the most satisfactory wheat under upland conditions for autumn sowing in the latter half of the rains. It contains yield, bird and rust-resistance and early maturity to a higher degree than any other variety so far tested under these conditions; but its bread-baking qualities are poor, though offset by a marked responsiveness to strengthening with other varieties.

19. Rice variety trials.

Observation plots were sited at Kota Kota (1,650') in a naturally-flooded basin of fair fertility. Excessive rain caused a reduction in all yields, and results were as follows :—

TABLE 29

<i>Variety</i>	<i>Yield (lb. paddy/acre.)</i>	<i>Length of term</i>
Demarara Creole ...	2,009 lb.	20 weeks
Maji-Maji ...	1,912 ,,	20 ,,
Faya (local selected)	1,008 ,,	22 ,,
Afaa Mwanza ...	728 ,,	20 ,,

Milling tests were also carried out on the first three varieties above and compared with ordinary Faya from commercial bulk. Results were as under :—

TABLE 30

<i>Variety</i>	<i>Milling Percentage</i>	<i>Percentage of Grade 1 rice</i>
Commercial Faya ...	67.9	89.9
Selected Faya ...	69.7	97.5
Demarara Creole ...	66.9	86.7
Maji-Maji ...	67.3	92.0

The above results indicate that Demarara Creole is an excellent yielder; that it is distinctly earlier maturing than Faya, but that it is less economic to mill and its long, slim grain is more liable to break. It is, however, a bright and attractive rice, but absence of flavour, as compared with Faya, counts against it with many local consumers. Maji-Maji, though shown to be a good rice by the above test, is unsightly and therefore unlikely to supplant Faya on the market. The good qualities of Demarara Creole warrant its further trial.

Trials of two local varieties and Burma A39 in Dedza district were abortive on account of damage due to excessive flooding.

20. Soya Beans.

Variety trials carried out for several years at Likuni have consistently shown Hernon (a non-shattering cross from Southern Rhodesia) to combine highest yield with best appearance. Dunfield matures earliest. The yields from these two varieties in 1945 were 624 lb. and 200 lb. per acre respectively.

21. Cow Pea.

Five varieties of cow pea were sown in observation plots at Likuni. An erect type from Zomba yielded considerably better than a similar type received from Amani, but was not noticeably superior to the local runner type which gave the most vigorous growth of all and was the most healthy in appearance. Actual yields were as follows :—

TABLE 31

Local runner	...	...	...	335 lb./acre
Erect type ex Zomba	...	...	...	348 " "
Erect type ex Amani	...	...	...	352 " "
Local selected erect (dark)	...	...	...	292 " "
" " " (light)	...	...	...	220 " "

22. Cotton breeding.

The Cotton Specialist of the Empire Cotton Growing Corporation reports that the C.L. 20 derivatives, which it is hoped contain a fair measure of Black-arm resistance, entered the multiplication plot stage this year and were compared in two small bulk trials with the best Mz.561 derivatives and certain other cottons. The latter again included local U.4 x Cambodia x U.4 crosses, N.C.—4 and N.C.—7, and with these were sown a range of the same parentage from Barberton. Also included were the Malwa Upland cross with U.4, numbered A.2208, from Barberton, and B.P.52 from Uganda. Leading places were taken by Mz. 561 and C.L.20 selections, with Mz.561 bulk equal first in both trials. T—22, the longest linted derivative from Mz.561, was also equal first. Of the C.L.20 derivatives which showed so much promise C.L.20-46 gave the second highest yield in the trial, 809 lb. seed cotton per acre as against 850 lb. seed cotton per acre from Mz.561 bulk. The Nyasaland Upland derivative B.P.52 did rather better in these trials than its bulk performance would have suggested, with a calculated yield of 610 lb. seed cotton per acre. The Nyasaland versions of the U.4 x Cambodia x U.4 cross were close to the leaders in the yield table. The relatively heavy bollworm attack experienced in these trials may have had some selective value, and it certainly adds to the confidence felt about the cropping power of the leaders.

23. Cotton Pest Control.

The Insect Pest Control Section of the Empire Cotton Growing Corporation working on Red Bollworm (*Diparopsis castanea* Hmps.), presented a report to the Nyasaland Government on the completion of their investigations. The report, which deals primarily with the Lower River Area, was published by Government in July, 1945. The recommendations by Mr. E. O. Pearson and Mr. B. L. Mitchell can be summarised as follows :—

Two diametrically opposed cotton growing techniques are outlined.

(a) Floodland or irrigated cotton, planted at the end of the rains, *i.e.* a late planted winter crop similar to that successfully cultivated in North Nyasa.

(b) Dry land rain-grown cotton, planted at the beginning of the rains, *i.e.* an early planted summer crop similar to that of the central areas of Nyasaland, but up-rooted not later than July 31st.

The two techniques are mutually exclusive, and the pest control work has demonstrated clearly that the idea of a compromise between them is incompatible with effective control of the major pest. To prepare the way for summer crop (*i.e.* technique (b)), should this be desirable, the further recommendation has been made that a non-cotton year, to reduce the pest population to reasonably small dimensions, be arranged.

